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ABSTRACT

A pilot study investigated the quality of diagnostic decisions that are made on the basis of a precise model of reading and learning to read. The study was carried out by creating a computer simulated reading clinician that embodied a recent model of the reading process and by observing the behavior of this simulated clinician as it diagnosed reading case records. Specific areas investigated were: (1) how well the simulation embodied the model, (2) how consistent and reliable the diagnostic decisions directed by the model were, and (3) how valid the diagnostic decisions directed by the model were. Findings indicated that the simulation was possible in as much as diagnostic test information provided answers similar to the items in the model, the simulation seemed to be reliable when comparing its diagnoses to those of reading clinicians, and the validity of the decisions was difficult to determine because case study information was inadequate. (MKM)

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Simulating the Diagnostic Performance of Reading Clinicians

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Abstract- The purpose of this study is to investigate the quality of diagnostic decisions that are made on the basis of a precise model of reading and learning to read. The study was carried out by creating a simulated reading clinician that embodies a recent model of the reading process and observing the behavior of this simulated clinician as it diagnoses reading case records. Questions of interest were 1)how well did the simulation embody the model, 2)how consistent and reliable were the diagnostic decisions directed by the model, 3)how valid were the diagnostic decisions directed by the model.

1.0 Introduction

A large scale research program directed by the Institute for Research on Teaching at Michigan State University has been exploring the nature of the clinical problem solving tasks involved in reading diagnosis and remediation and the nature of the behaviors of reading specialists, learning disability specialists and classroom teachers as they diagnose and remediate. The research to date seems to indicate that although the individual clinicians and teachers do believe that they are searching out the students' problems rationally and reasonably, their behavior is, in fact, unreliable and idiosyncratic. It depends more upon the particular clinician working with the case and the initial data he perceives than upon the children's actual disabilities (Vinsonhaler, 1979).

This unsuspected lack of consistent behavior appeared among clinicians considered most expert and senior by their colleagues. It appeared among different diagnostic sessions by one clinician as well as among different diagnostic sessions run by different clinicians. The clinicians did not agree with themselves or each other on the diagnosis for a particular case. A number of explanations have been offered to account for these observations. Most have been rejected on the basis of further research (Gil, 1979, Weinshank, 1979, Hoffmeyer, 1979, Van Roekel, 1979, Stratadoukis, 1979). One potential explanation that has not been thoroughly examined is that the clinicians lack the knowledge to perform well.

The model that the clinicians used to direct their decision

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making process may be inadequate for the task at hand. This explanation highlights a possible need for improved instruction for reading diagnosticians in a good model for reading diagnosis. The little observational data that has been collected on this issue indicates that, although most clinicians did behave with purpose, this purpose rarely evolved from a model of the process of reading and learning to read in which the various aspects of a particular case might be collected and integrated (Vinsonhaler, 1979).

The purpose of this research was to pilot the examination of clinical diagnosis for reading disabilities when this care is directed by a precise model of the reading process and the process of learning to read. This was accomplished by studying a computer simulation that embodied a recent model of reading and learning to read (the MORAL model, Sherman, Vinsonhaler & Weinshank, 1979) as the simulation interacts with a number of case records.

2.0 The Computer System

The first step in the creation of a computer simulation of clinical problem solving was the definition of what the significant behaviors were. The similarities and differences of diagnosis across various content areas are summarized in the figure below.

Figure 1
Similarities and Differences of Diagnosis Across Fields

Commonalities	Differences
*problem initiated	*contents of knowledge
*one-on-one	*prevailing view of products
*special knowledge required	*prevailing view of process
*purpose is Dx and Rx	
*information collected on system	
*reliability & validity of Dx	

Further analysis of the behavior of medical and reading clinicians has lead to the following conceptualization of a clinician. It is this conceptualization of a clinician that has directed the simulation of clinical problem solving.

The computer simulation of a reading clinician was setup on Wayne State University's MTS operating system running on an Amdahl 460v6. Anyone having access to TELENET can potentially access and experiment with the simulations.

Figure 2
Inquiry Conceptualization of a Clinician

Input	Output
*case behavior	*diagnosis
*other environmental input	*remedial plan
	*requests for information
Memory	**Process**
*categories	*cue selection
*cue	*cue collection
*remedial plans	*category generation
*associations of:	*category acceptance
cues->categories	*category rejection
categories->cues	*diagnosis statement
categories->remedial plans	*remediation statement

Finally, in order to prepare the simulated clinician for the environment in which it must work, the significant characteristics of the case were explicated.

Figure 3
Inquiry Conceptualization of a Case

Input	Output
*clinician requests	*responses to clinician
*other environmental input	*other process output
Memory	**Process**
*memory required by process	*system process

3.0 A Model of Reading and Learning to Read

A recently developed model of the reading process that seems most promising as a heuristic for thinking about reading diagnosis is the Model of Reading and Learning (MORAL) developed initially by Sherman (Sherman et al., 1979). Consider first the specifics of that model.

The MORAL is a theoretical model of the process of reading and the process of learning to read (Sherman, Vinsonhaler & Weinshank, 1979). The MORAL views the reader as a processor of information. Any information processor can be conceptualized as an entity that

1)receives input from the environment, 2)processes this input in conjuction with its own memory of past events and 3)produces an output that impacts the memory, the environment, or both. (Note how nicely this fits the Inquiry theory conceptualization of a case.) A particular reader attempting a particular reading task, then, receives as input the requirements of the task. This input, together with his past knowledge of reading and language, are processed in some way. Outputs are produces - some which are unobservable (e.g., changes in memory) and some of which are observable (e.g., performance on the reading task as measured in a particular way).

Within this view of an information processor, another critical concept is that of processing capability - the limits that exist on how much information can be processed at what speeds. For any processor, these limits exist. Furthermore, as the requirements of the tasks involved approach the limits of the processing capacity, the efficiency of the process declines. In a reader, this capacity limit is demonstrated many ways. If some sub processes of reading are too inefficient (i.e., too resource-consuming) other processes can suffer. Poor word attack skills may require so much effort in their use that little is left for comprehension. With reading another factor is significant - the information processing capacity itself changes. Depending on motivation or attention level, the capacity allocated for reading tasks varies. This is often seen in children who cannot perform independently but can perform under direction - due to increased extrinsic motivation.

Let us consider the MORAL in greater detail. The first step it takes is to differentiate among some of the sub processes that have been identified by practicioners and researchers in reading and comprehension. Six reading subprocesses are identified that fall into two groups. These six have been labeled "vital" processes. "Vital" indicates that to the degree that the process is inadequate, some tasks in the range of reading situations will be deficient.

In addition to these vital processes of reading, two vital control processes that determine information processing capacity allocated to reading tasks are also identified. These processes can directly impact the other six by changing the capacity available to them.

The six reading and two control vital processes are the topics of the next three sections.

3.0 A Model of Reading and Learning to Read

3.1 The Word Comprehension Process

The word comprehension process is the means by which a reader associates the graphemic visual stimuli of a word with its meaning in memory. This overall process may be subdivided into the word recognition process and the word meaning process; the word recognition process may be defined in terms of the instant word recognition process and the decoded word recognition process. Let use consider these three vital reading processes separately.

The Instant Word Recognition Process

Instant word recognition is defined as the association of a visual stimuli (or other visual segment) with its internal prototype, the transformation to be of short latency.

The Decoded Word Recognition Process

Decoded word recognition is defined as the association of a visual stimuli with its internal prototype, the transformation not being of short latency. The transformation occurs by applying rules to the visual prototype that predicts sound values from the visual prototype and then uses this prediction as further input to the internal prototype association process.

The Word Meaning Process

The word meaning process is defined as the association of a word prototype with its semantic meaning. This can occur once the input stimul has been associated with its prototype

3.2 The Message Comprehension Process

The processes involved in message comprehension can be divided in a way analogous to that for word comprehension. First, a distinction can be made between the construction of meaning from the text and the association of this construction to long term memory frames. Then, the construction from the text may be divided into two parts - the "instant message construction" called the text segmentation process in which sets of propositions called microstructures are extracted from the text, and the "decoded message construction" called retentive comprehension in which a series of elementai

microstructures are combined through a certain set of rules called macro rules into macrostructures.

The Text Segmentation Process

The text segmentation process is defined as the association of sets of word meanings to sets of propositions called microstructures. This transformation is usually of short latency.

The Retentive Comprehension Process

The retentive comprehension process is defined as the association of a set of microstructures to a set of macrostructures.

The Message Meaning Process

The message meaning process is defined as the association of macrostructures constructed from the text with frames of meaning from memory. This can occur once the micro and macro structures have been built up.

3.3 The Attending/Motivation Control Process

The attending/motivation control process is concerned with the manner in which the information processing capacity of the individual is allocated to the tasks required for reading. Attention to tasks involved in the reading environment seems to be a major determinant of reading capability. Further, knowledge of motivation to perform must exist for an observer to correctly infer the state of the covert reading processes from the overt performances. This vital control process of attention/motivation can be subdivided into the extrinsic motivation process and the intrinsic motivation process.

The Extrinsic Motivation Process

The extrinsic motivation process is concerned with the change in capacity allocated to the reading tasks that occur as a result of influences outside the reader.

The Intrinsic Motivation Process

The intrinsic motivation process is concerned with the change in capacity allocated to the reading tasks that occur as a result of influences inside the reader.

4.0 Methods and Procedures

The purpose of this study was to pilot an examination of the diagnostic performance of a precise model of clinical care in reading. The procedures required to achieve this purpose included the following:

1) Careful explication of the MORAL reading processes to the level of specificity required to implement them on computer.

2) The development of a simulated reading clinician that embodied the Inquiry theory as its model for diagnosis and the MORAL for its understanding of the reading process.

3) The selection of 2 reading case records of children that had been treated at MSU's reading clinic. An attempt was made to select cases for which the diagnosis was relatively clear as indicated by response to treatement.

4) the diagnosis of these case records was carried out by the MORAL/Inquiry Theory SIMCLIN. One case record was diagnosed twice with differing presenting information.

Let us turn to each of these procedural components in turn.

4.1 The Explication of the MORAL

The explication of the MORAL was aided by the following heuristic table. This table reflects a number of questions that could be asked about how a general purpose internal process might be applied to a particular performance outcome. It includes concerns on the overall performance of the process, the various subcomponents of the process, the learning of the process and the learning of particular performances. The table was then applied to reading as a whole, and each of the six vital processes of the MORAL to generate potential categories that should be considered in the MORAL.

Figure 4
Simulation Specification Aid

Process

- Current State of Process
  - Performance
    - At Grade Level
    - At Antecedent Condition Level
  - Antecedent Capability Status
    - Input
      - Existing
      - Potential
    - Memory
      - Existing
      - Potential
    - Process (using memory and input properly)
      - Existing
      - Potential
    - Use (in various tasks requiring it)
      - Existing
      - Potential
    - Attention (information processing capacity allocated)
      - Existing
      - Potential
- Past Experience Effecting Learning
  - Learning of Performance (on various tasks, including measurement ones)
    - Attention
    - Amount
    - Distribution
    - Meaningfulness
    - Feedback
    - Antecedent Conditions for Learning

4.2 The Development of a MORAL/Inquiry Theory SIMCLIN

The development of the MORAL Inquiry/Theory SIMCLIN was carried out as follows:

1) Two problem representations were created for each of the areas generated by the above table - one representation indicating that the area was adeqauate, one that it was inadequate.

2) Cues were used from a previous MORAL SIMCLIN and some new cues were created that could be used to define the adequacy of each area.

3) Each problem representation was logically linked to the other problems in the following way: an inadequacy in performance would cause the consideration of the adequacy of all antecedent conditions, the inadequacy of any antecedent condition would cause the consideration of the adequacy of the learning conditions.

4) A strategy was created that included the following significant features: it was hypothesis directed, it collected a standard set of information at the beginning of the encounter on the vital processes, it prohibited the consideration of any of the problems until an inadequate vital sign demanded further depth of search.

5) The data were cross checked a number of times using various indexing techniques in an attempt to assure that the data was accurate.

6) The necessary data files were created for the BMIS computer system.

4.3 Case Record Selection

The case selection procedure was carried out in the following manner:

1) Approximately one hundred records in the MSU reading clinic since 1975 were examined searching for those in which two diagnostic workups had been given. The results of this search uncovered a few such records - however, the second workup in every case examined only cognitive capability with the ITBS and the WISC-R. As such, there were no cases in which the correctness of the diagnosis could be verified by comparing an original diagnosis and a later diagnosis to check for improvement. This case selection procedure was rejected.

2) The records were again consulted - in this case looking through tutor records in which recommendations were made that the student need no longer attend the clinic or that the student needed to return for more assistance. This could serve as another measure of correctness of diagnosis. Cases were uncovered in which the student had remained in the clinic for a period of three years with recommendations that he return again. Others were found that indicated that the student no longer needed the clinic's assistance.

3) It appears that, although a selection method was defined and a selection could be made on its basis, the case selection was probably unable to identify the two types of children originally

desired - i.e., one who responded well to treatment and one that responded poorly. The tutor reports are made by generally inexperienced students - some of whom have not even achieved a B.A. In the first place, such reports are likely unreliable. Secondly, the fact that a student must return to the clinic does not infer that the student has not made progress - it may merely be a reflection of the long distance he must cover. These problems prompted consideration of a third selection method - the selection by expert opinion - selection by the head of the reading clinic. In discussions that ensued, this proceedure located a number of children substantially helped but only pathological cases for nonimproved readers.

4) The final selection method was a combined approach of taking the expert opinion of the reading clinic personnel tempered with the length of stay and tutor evaluation. One child was helped substantially and quickly. One child was helped every term for three years - from grades two through four. The lack of correction at this early age given that much time would indicate that some vital reading or affect process was not adequately addressed.

4.4 The Diagnosis of the SIMCLIN

The SIMCLIN diagnosed the two case records, one record twice. For illustrative purposes, one of these diagnoses is included in total as an appendix. The behavioral data by the SIMCLIN's is the source of most of the data in the data analysis section of this report.

5.0 Data Analysis

Data analysis consists of descriptive data in the following areas:

1) Characterization of completeness of SIMCLIN diagnosis when mapped onto the requirements of the MORAL (How well does the simulation model the MORAL?)

2) Comparison of SIMCLIN diagnosis with reading clinic criterion diagnosis (How valid are the SIMCLIN diagnoses?)

3) Comparison of SIMCLIN diagnoses on same cases with varying entry data (How reliable is the SIMCLIN given the same case more than once?)

4) Other descriptive data and implications of the pilot study.

5.1 SIMCLIN Representation of MORAL

The SIMCLIN working with the MORAL would be expected to perform in the following way: 1) Check out the six vital processes of reading through the vital signs 2) For each process that is adequate, no further work is needed. 3) For each process that is inadequate, check out the antecedent tasks. 4) For any antecedent task that is inadequate, check out the learning tasks.

In examining the performance of the SIMCLIN on the two runs the following behavior was noted:
1) The SIMCLIN always checks out the six vital processes of reading at the vital sign level.
2) For any inadequate process that was placed into the diagnosis, the SIMCLIN considered the state of the antecedent tasks.
3) For any inadequate antecedent process, the SIMCLIN considered the state of the learning history of the antecedent tasks.

In many ways, however, the adherence to the MORAL by this SIMCLIN is a moot point. Of prime importance in this study, although the SIMCLIN did, in fact, attempt to follow the MORAL dictates, the SIMCLIN was thwarted at every turn by the unavailability of information on the case. The cases lacked any type of data dealing with the learning conditions of any of the vital processes - making the diagnosis of these significant effecting factors impossible. Further, the diagnosis of even some antecedent factors was limited due to this same lack of information. The conclusion must be that the SIMCLIN did embody the MORAL to the level of what could be observed but was unable to show its complete working due to lack of information. Of course, in this conclusion we are speaking of the current version of the MORAL and the level that it is possible to include it on computer.

5.2 SIMCLIN vs Clinic Validity: Which is criterion?

The diagnosis of the SIMCLIN and the Clinic were to be compared. The intent was that the Clinic diagnosis would serve as a criteria if cases were selected such that the child improved in the clinic. Furthur, in the selection of the one "bad" case, it was assumed that the lack of improvement would infer a lower level of correctness in the Clinic diagnosis.

In fact, the diagnoses of the SIMCLIN do not appear to be that different from those of the clinic. This was rather suprising, initially, considering the nature of the clinic workups. The reasons become clearer when one considers the following points. 1) First of all, the diagnoses in the Clinic serve many purposes not

intended for the SIMCLIN. The Clinic reports are for parents - and, therefore, include a great deal of information on test administration, test results and interpretations that the SIMCLIN was not designed to do. From the diagnostic report, only the summary and recommendations were used for comparison with the SIMCLIN - the observational reporting of test behavior is included in SIMCLIN potential behavior. Of course, throwing out twenty pages in a twenty five page report greatly decreases the ways in which the clinic diagnosis can be more complex than the SIMCLIN diagnosis. 2) Second, the Clinic case records did not contain information on the learning tasks of the vital processes antecedent conditions. Because of this, the range of possible behaviors in which the SIMCLIN might engage was markedly restricted, and it was restricted, apparently, in the one area not ever mentioned in the clinic diagnoses at all - the learning factors. 3) Third, even for the antecedent conditions, some of the data that the SIMCLIN might collect was unavailable. The SIMCLIN would attempt to study the decoding skills of segmentation, sounds, blending, and adjustment of blending in a manner not recorded in the Clinic records. All considered, the two diagnoses appear far more similar than they should. The diagnoses of the SIMCLIN and the Clinic on the two cases are listed below:

SIMCLIN Case Good	Clinic Case Good
IWRP IADQ GRADLEV	Sight Vocabulary Limited for Grade Placement
IWRPU ADQ	
PCP ADQ ACL	
PCP IADQ GRADLEV	
PCPU IADQ SPEED	Rather Slow Rate
SELFCON IADQ	
VISTMPRO LINK IWRP IADQ CONF	Relies on General Form of Word
VISTMPRO LINK IWRP IADQ FRST	Relies on Initial Letters of Word
VISTMPRO LINK IWRP IADQ VISDISC LTRS	
WMP ADQ GRADLEV	Has Meaning for More Words than he is able to Recognize

5.2 SIMCLIN vs Clinic Validity: Which is criterion?

SIMCLIN Case Bad	Clinic Case Bad
IWRP IADQ GRADLEV	Signt Vocabulary Quite Scanty
IWRPU ADQ	
PCP ADQ ACL	
PCP IADQ GRADLEV	
PCPU IADQ SPEED	
SELFCON IADQ	
VISTMPRO LINK IWRP IADQ CONF	Relies on General Form of Word
VISTMPRO LINK IWRP IADQ FRST	Relies on Initial Letters of Word
VISTMPRO LINK IWRP IADQ VISDISC	
LTRS	
WMP ADQ GRADLEV	

The computer diagnoses have been described in the actual computer phrases. The terms in the phrases are abbreviations. Specifically,
IWRP=Instant Word Recognition Process
IWRPU=Instant Word Recognition Process Usage
PCP=Phrase Comprehension Process
ACL=At Antecedent Level
ADQ=Adequate
VISTMPRO=Visual Stimulus to Prototype
etc. The terminology used is more completely detailed in the MORAL (Sherman et al, 1979). Before leaving this topic, one point should be made. In comparing the diagnoses here, it became especially clear that the comparison was based on two parts: 1) the diagnostic "understanding" about the case and 2) the decisions as to what should be included in a diagnostic report. The most significant comparison would be between the former aspects without being muddied by the latter. That is what needs to be compared, somehow, next time.

5.3 SIMCLIN Reliability

The SIMCLIN reliability in this experiment can be stated easily: the product measure of "phrases included in the diagnosis" was perfectly reliable.

These results indicate that the SIMCLIN may be capable of reliability far above what human clinicians could achieve.

5.4 Simulation of MORAL/Inquiry Theory Reading Clinician

Looking back over the study, the overall impression is that the problems encountered while attempting to complete the study are of far more importance than the behvaioral data described above. In the following sections, some of the major concerns will be addressed.

SIMCLIN Creation

The creation of a SIMCLIN required the statement and interrelation of a number of potential classifications for readers and the description of these classifications in terms of observable cues. The first task was relatively straightfoward; the second was horrendous - possibly implying that the first task was poorly done.

The information processing / input-output type of analysis applied herein was a logical process. Given a postulated process with certain known inputs and outputs and some unknown others, descriptions were generated for potential ways in which the processes might interact. Then, more descriptions concerning important effectors. More descriptions concerning significant prerequisites. The task was an enjoyable and thought provoking one.

But then came the task of tying these factors to the real world. This bonding to reality has been initiated in the Clinical Studies Projects of the Institute for Research on Teaching as the MORAL Instrumentation Project. But for this study, such information was unavailable. Instead, armed with a large set of cues developed with Dr. George Sherman, a great number of the factors suggested by the logical analysis could be examined. In some cases, new cues had to be created. In some cases, certain factors of the processes were logically confounded given current inability to get inside the brain to watch it word. examination. In some cases, certain factors could not be observed in any way - by inference or otherwise. In no case is the set of cues used for this study nearly complete enough for a truly excellent SIMCLIN.

The method of attack that needs to be carried out is, for each factor suggested by the MORAL, a precise operational definition of the factor must be given. Furthermore, the conditions, behaviors and criteria must be stated under which a particular classification decision can be made.

For an example, consider the ability to correctly segment multisyllable words for later sounding and blending. Does the observation of the student as he reads a standard oral reading

passage at an upper grade level provide enough information? If he comes to words that are unknown and sounds them out, then maybe it is. But how many must be observed? What percentage must be done correctly?

Clearly, the instrumentation of the MORAL must consider the development of tests in isolation and context, under direction and independently, orally and silently, formally and informally. But more important than this is, given a set of information about a child, how can the information be integrated to achieve the maximium information with the minimum expenditure.

With respect to this study - there remains the question that a great deal of information was available in the Clinic records that was not used due to insensitivity of the SIMCLIN information collection techniques. Information that a clinician would use to develop an internal image of the reader - one that helps to correlate and integrate the rest of the information - is not now available for use by the MORAL or the SIMCLIN in the study. Further work is sorely needed.

Existing Tests and the MORAL

In the same vein, consider the existing tests that have been used in the Clinic and that are available elsewhere. In terms of the MORAL, most of the tests fail to obtain information on all facets of the tasks as directed by the MORAL. For example, one important consideration of the MORAL is the word meanings associated with word recognition. If the reader cannot accurately sound out a word, the MORAL would require a check on the meaning of the word - since the adjustment of the blended sounds to conventionally spoken form requires that the word be in the reader's language experience. Of course, many or most reading diagnosticians would make this kind of check whether the test called for it or not. But the tests do not direct its collection - and a non expert diagnostician might not collect a significant piece of information. But a careful description of all the kinds of MORAL information available on each kind of test will be a requirement for a good MORAL SIMCLIN.

Reaction to Treatment as Criterion

One of the real problems involved with this study was the attempt to use reaction to treatment as the criterion for correctness of diagnosis. A number of problems were encountered.

First, over what time period must the improvement take place

and to what degree if one is to say that the diagnosis correctly predicted improvement. If the Clinic diagnostician's diagnosis is correct, will improvement be expected within one term? Within one year? How much improvement must occur? If no improvement of the desired amount occurs in the specified time, does that mean the diagnosis was incorrect?

The slippery nature of this question is one of the main factors that resulted in the case selection difficulty described earlier. No logical answers are obvious. Possibly, arbitrary thresholds must be defined.

Second, reaction to treatment can only be determined by a second measurement of the state of the reader's reading capabilities after treatment has occurred. In this experiment, even the first measurement was difficult to compare to the MORAL. The second measurement was unavailable. In general, it would appear that a full diagnostic workup would be required to correctly discern the reaction to treatment.

The third concern is the relation between diagnosis and treatment. This concern has been addressed by other studies in its natural state (Weinshank, 1979), but here we must be concerned with the association of a MORAL diagnosis with a MORAL treatment. For this study, it is not at all apparent that the diagnosis of the Clinic diagnostician in any way effected the treatment the cases received. It is not clear that it should. Quite possibly, if the cases are required to practice reading and their motivation is increased - whatever the problem it will decrease.

The conclusion must be that the criteria of reaction to treatment could not be effectively used in this setting.

6.0 Conclusions

This pilot SIMCLIN was created on a system that is being replaced by a newer and more powerful one. The memory of the SIMCLIN depended on a MORAL that is neither complete theoretically nor in its connections to real world observations. The cases upon which the study was run were incomplete for even the limited information that this SIMCLIN memory required.

Despite this, as a pilot the results were excellent. A number of important concerns were uncovered for the next attempt at creating a MORAL SIMCLIN. The successive SIMCLIN's cannot help but get better as the MORAL is explicated and the new simulation system, MOSES, is introduced. The potential for an intelligent, reasonable, simulated clinician of reading problems will be progressively

achieved at ever higher levels. It looks like fun.

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8.0 Appendix: Figures Used During AERA 80 Presentation

The figures that follow were used during the presentation of this paper at the 1980 meeting of the AERA in Boston.

Figure 1

The Setting

Motivation -

*Unreliable diagnostic report and remedial suggestions
*Rejection of most other explanations for unreliability
*Improvement in reliability shown in training studies

Purpose of study -

Examine the validity of diagnostic reports generated by a particular, precise model of reading and learning to read. (Validity in terms of improvement in reading abilities when the diagnosis is based on the model.)

Design -

*Computer simulation as embodiment of model
*Clinic case records as case
*One good case, one bad case
*Two diagnoses of the same case

Questions-

*Fidelity of Simulation with respect to MORAL
*Reliability of SIMCLIN
*Validity of SIMCLIN diagnosis

8.0 Appendix: Figures Used During AERA 80 Presentation

Figure 2

What is a Simulated Clinician (SIMCLIN)

*Clinical Memory	*Clinical Memory Representation
Strengths	Strength Representations
Weaknesses	Weakness Representations
Observations	Observation Representations
Treatements	Treatment Representations
Prescriptions	Prescription Representations
Cues	Cue Representations
Relationships	Relationship Representations
*Elementary Information Processing Tasks	*Elementary Computer Subroutines
Routine cue collesion	Routine cue subroutine
Hypothesis directed cue collection	Hypothesis directed cue subroutine
Hypothesis generation	Hypothesis generation subrout
Hypothesis evaluation	Hypothesis evaluation subrout
	Diagnosis judgement subroutin
Diagnosis termination	Diagnosis termination subrout
*Strategies	*Sequences of Elementary Compute Subroutines
Overall Strategy	Initial Elementary Computer Subroutine List
Substrategies	Sublists of Elementary Compu Subroutines dependent upon c

Note that: The contents of Clinical Memory and the particular strategies employed reflect the clinician's model of the case processes. In reading this process model is a model of how a child reads and learns to read. In the Simulated Clinician, the model was the MORAL (Model of Reading and Learning).

8.0 Appendix: Figures Used During AERA 80 Presentation

Figure 3

Case Selection

100 records 1975-1979 examined

criterion for selection of good and bad case - length of time at clinic and advice of senior reading specialists

rejected criterion for MSU clinic - tutor recommendations, improvement demonstrated by further diagnostic testing

8.0 Appendix: Figures Used During AERA 80 Presentation

Figure 4

Computer Diagnosis

Computer simulation based on MORAL directs interaction

Start up simulation

Answer all questions possible that Simulation asks based on case records

Record diagnosis of Simulated Clinician

8.0 Appendix: Figures Used During AERA 80 Presentation

Figure 5

Sample Interaction

```
    PLEASE INPUT THE SYMPTOMS AND SIGNS FOR THE INITIAL
    CONTACT WITH THIS CASE.  INPUT THEM AS STANDARD CUE NAMES
    ONE PER LINE, NO COMMAS.  (END LIST WITH A BLANK LINE)
?C STUDENT SELF CONCEPT IAPP IINT
?
  ****************************************
 WHEN YOU ARE READING YOUR SCHOOL BOOKS AND COME TO A WORD YOU DON'T
 RIGHT AWAY, CAN YOU GENERALLY FIGURE IT OUT?
?NO
```

8.0 Appendix: Figures Used During AERA 80 Presentation

Figure 6

Sample Interaction (continued)

```
THE HYPOTHESES GENERATED ARE:
RELEVANCE                                HYPOTHESIS
-------------------------------------------------------------------------

    SELF CONCEPT AS A READER LEARNER INAPPROPRIATE
    INSTANT WORD RECOGNITION APPROPRIATE
    INSTANT WORD RECOGNITION INAPPROPRIATE
    RETENTIVE COMPREHENSION AT INSTANT WORD RECOGNITION LEVEL APPR
    RETENTIVE COMPREHENSION AT INSTANT WORD RECOGNITION LEVEL INAP
    PHRASE COMPREHENSION AT INSTANT WORD RECOGNITION LEVEL APPROPR
    PHRASE COMPREHENSION AT INSTANT WORD RECOGNITION LEVEL INAPPRO
    DECODED WORD RECOGNITION PRIMARY LEVEL APPROPRIATE
```

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.
.

8.0 Appendix: Figures Used During AERA 80 Presentation

Figure 7

Sample Interaction (continued)

```
 ****************************************
SELECT READING MATERIAL APPROPRIATE TO THE STUDENT'S INSTANT WORD
RECOGNITION ABILITY.
POSSIBLE SOURCES INCLUDE:
  ORAL READING SUBTESTS FROM DIAGNOSTIC BATTERIES
  TEXTS USED IN THE GRADE APPROPRIATE TO THE STUDENT'S INSTANT WORD
    RECOGNITION PERFORMANCE.
ASK THE STUDENT TO READ IT ALOUD.
MAKE A TRANSCRIPTION OF PERFORMANCE INDICATING THE WORDS MISCUES.
REVIEW THE TRANSCRIPTION.
ARE THE MISCUES SYNTACTICALLY APPROPRIATE?
?Y
```

.
.
.

8.0 Appendix: Figures Used During AERA 80 Presentation

Figure 8

Sample Interaction (continued)

```
  ****************************************
EXAMINE THE RESULTS OF A GRADED WORD LIST (ADMINISTER IF NECESSARY)
ADEQUATE WORD LISTS INCLUDE:
      SLOSSON
      SAN DIEGO
      GRADED LISTS FROM DIAGNOSTIC BATTERIES

DOES THE SCORE MEET THE CRITERIA IN THE FOLLOWING TABLE?

GRADE PLACEMENT   GRADE SCORE
 ---------------------------
   1.0 - 1.9        1.5 - 2.0+
   2.0 - 2.9        2.0 - 3.0+
   3.0 - 3.9        3.0 - 4.0+
   4.0 - 4.9        4.0 - 5.0+
   5.0 - 5.9        5.0 - 6.0+
   6.0 - 6.9        6.0 - 7.0+
   7.0 - 7.9        7.0 - 8.0+
   8.0 - 8.9        8.0 - 9.0+
?Y
```

8.0 Appendix: Figures Used During AERA 80 Presentation

Figure 9

Sample interaction (conclusion)

```
  **********************************************************************
  THE SYMPTOMS AND SIGNS INDICATE THAT THE CLIENTS PROBLEM(S) INCLUDE
SELF CONCEPT AS A READER LEARNER INAPPROPRIATE
RETENTIVE COMPREHENSION APPROPRIATE
  **********************************************************************
```

.
.
.

8.0 Appendix: Figures Used During AERA 80 Presentation

Figure 10

Model of Reading and Learning
General Framework

	Vital Signs	Vital Process Effecting Factors	Learning Process Effecting Factors
Instant Word Recognition			
Decoded Word Recognition			
Meaning Vocabulary			
Oral Reading			
Reading Comprehension			
Listening Comprehension			
Attention/ Motivation			

8.0 Appendix: Figures Used During AERA 80 Presentation

Figure 11

Model of Reading and Learning Strategy

*Routine Checkout of Vital Signs by Interview
*Further checkout of Vital Signs by Observation
*Checkout of Vital Process Effecting Factors for Problematic Vital Signs
*Checkout of Learning Process Effecting Factors for Problematic Vital Signs
*Hypothesis Directed Inquiry
*Diagnosis to include Causal Relationships

8.0 Appendix: Figures Used During AERA 80 Presentation

Figure 12

Results

Fidelity of Modeling of MORAL

*hypothesis directed
*covered vital signs
*covered vital process effecting factors of problematic vital signs
*covered learning process effecting factors of problematic vital signs

Reliability of Simulated Clinician

*reliability between computer dx #1 and computer dx #2 on same case
*value essentially 1.0

Validity of Simulated Clinician

*computer dx vs clinic dx
*good case vs bad case

8.0 Appendix: Figures Used During AERA 80 Presentation

Figure 13

Discussion

Difficulty of Creation of Simulation

Instrumentation of MORAL

Remedial Technology and the MORAL

Reaction to Treatment as a Validity Criterion

Future Directions

*New simulation system
*computer aided diagnosis

8.0 Appendix: Figures Used During AERA 80 Presentation